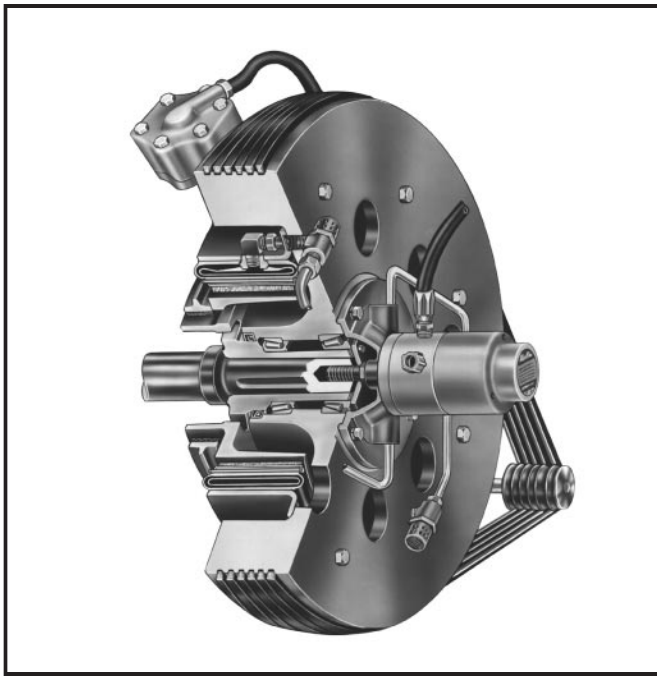
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> ⚠ **Warning**
> **Forward this manual to the person responsible for Installation, Operation and Maintenance of the product described herein. Without access to this information, faulty Installation, Operation or Maintenance may result in personal injury or equipment damage.**

Installation, Operation and Maintenance of the Airflex® FSPA Applications



⚠ **Caution:**

Use Only Genuine Airflex® Replacement Parts

The Airflex Division of Eaton Corporation recommends the use of genuine Airflex replacement parts. The use of non-genuine Airflex replacement parts could result in substandard product performance, and may void your Eaton warranty. For optimum performance, contact Airflex:

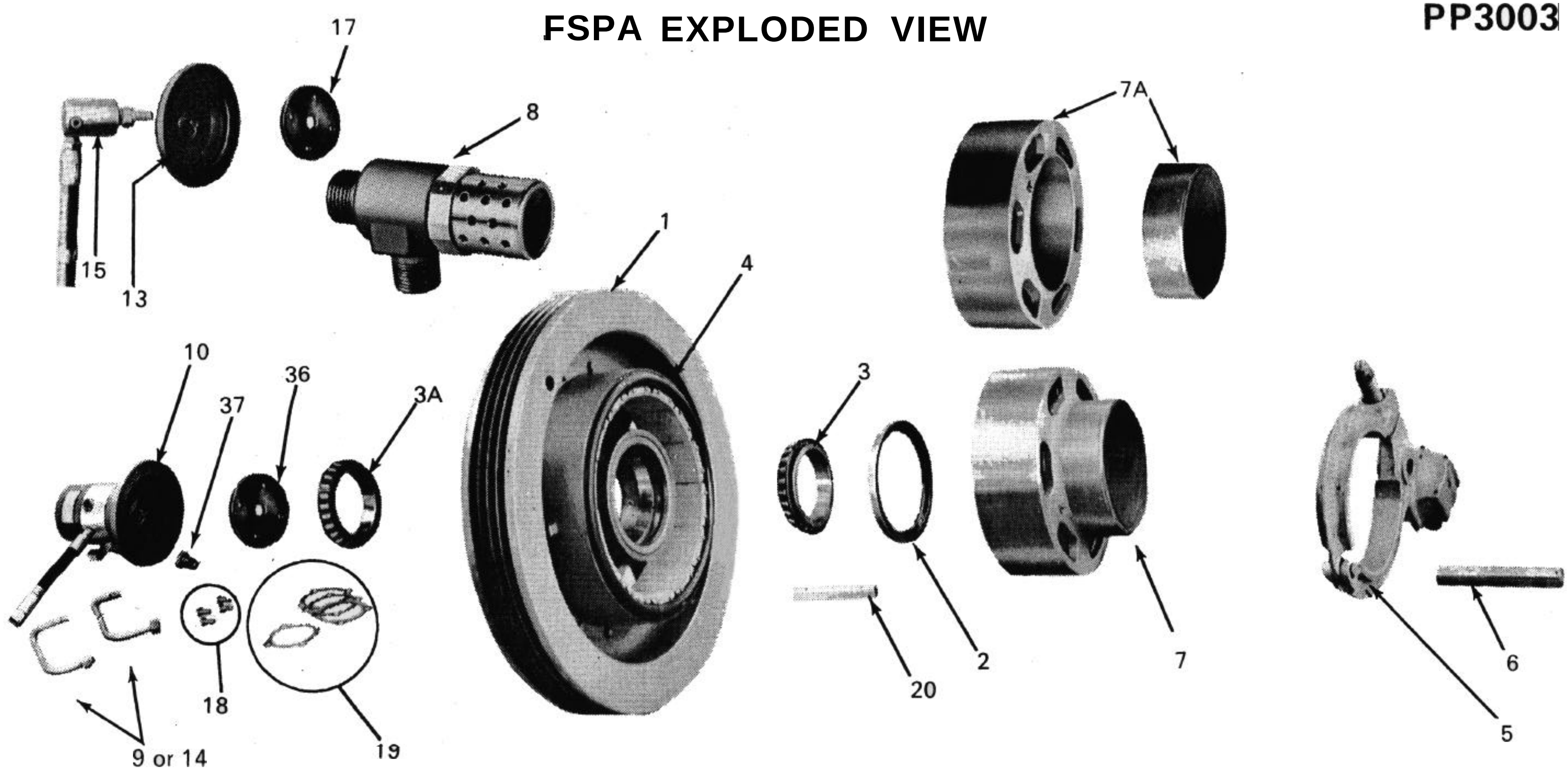
In the U.S.A. and Canada: **(800) 233-5890**
Outside the U.S.A. and Canada: **(216) 281-2211**

EATON

February, 1981
203673 PDF Format

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FSPA EXPLODED VIEW



1. NEW FLYWHEEL OR BULLGEAR
2. OIL SEAL
3. INNER TIMKEN BEARING CONE
3A. OUTER TIMKEN BEARING CONE
4. AIRFLEX CB OR VC TYPE CLUTCH
5. AIRFLEX CS OR CTF TYPE BRAKE
6. REACTION PIN
7. COMBINATION CLUTCH BRAKE DRUM
7A. SEPARATE CLUTCH BRAKE DRUM
8. AIRFLEX QUICK RELEASE VALVE AVAILABLE WITH OR WITHOUT MUFFLER
9. AIR TUBES
10. AIRFLEX TIMING ROTORSEAL
13. ROTORSEAL ADAPTER
14. AIR TUBES
15. ROTORSEAL
17. END PLATE
18. CAP SCREWS
19. SHIMS
20. KEY
36. END PLATE
37. TIMING ROTORSEAL DRIVE SCREW

I.OPERATION

A. DESCRIPTION

The Airflex FSPA is a self-contained clutch-brake package designed primarily for power press applications. The standard FSPA sizes available are ideally suited for and can be easily adapted to practically all OBI, straight-side and like presses from two ton capacity and up. It can also be used on other types of machines requiring high cyclic operation. The major components of the FSPA package are:

1. Airflex "CB" or "VC" clutch.
2. A new flywheel or bullgear with anti-friction bearings.
3. Airflex spring applied air released brake.
4. Clutch and Brake Drums
5. Airflex quick release valves.
6. Timing rotorseal or standard rotorseal.

B. HOW IT WORKS

The combination or separate clutch and brake drums are keyed to the shaft. The bearing mounted flywheel or bullgear mounts and rides on the outside diameter of the clutch drum hub. The clutch element is attached to the flywheel or bullgear. Air to engage the clutch is introduced through a timing rotorseal or standard rotorseal. The brake is attached to and reacted by the press frame.

Starting and stopping is accomplished by the simultaneous action of the clutch and the brake. Air to engage the clutch simultaneously releases the brake, allowing the press crankshaft to rotate. When the air pressure to the clutch and brake is exhausted, the clutch disengages rapidly and the spring applied brake is engaged, thus stopping the crankshaft. The timing rotorseal or separate timer signals the solenoid valve, which controls the air to the clutch and brake, at the proper point during crankshaft rotation.

II. INSTALLATION

All Airflex FSPA applications are shipped from the factory partially assembled so that a minimum amount of work is necessary for installation on the press.

A. MOUNTING

The following instructions are provided to guide you through the recommended assembly sequence. Please read these instructions thoroughly prior to performing the actual work. See exploded view.

Customers who rework their own shafts will require all the instructions contained herein for assembly of the parts. Customers who send their shafts to Airflex for machining and assembly should disregard items one through fourteen.

1. Machine the shaft on which the FSPA unit is to be mounted according to dimensions shown on "Dimensional Data" sheet. This entails turning the shaft to a specified diameter and distance from the press frame bearing as well as cutting the keyway or keyways as shown.

NOTE: For Special bores not listed, machine the shaft diameter to provide an interference fit of approximately .0005" per inch of shaft diameter.

When a timing rotorseal (10) is used, the end of the shaft must be drilled and tapped for the timing rotorseal drive screw (37). (See note 5 on "Dimensional Data" sheet.)

Where the standard rotorseal adapter (13) is used, two holes must be drilled and tapped in the end of the shaft 180 degrees apart to secure the end plate (17).

NOTE: One exception to this is on the small size FSPA No. L-l where a relatively small shaft diameter limits the number of mounting holes to one in the center of the shafts. See tabulation on "Dimensional Data" sheet.

2. Before inserting the key (20) into the shaft, remove all burrs or nicks from the key, keyway and shaft.

3. With key in place, coat the shaft and key with oil, or preferably with white lead and oil.

4. Heat the combination clutch and brake drum (7) either in oil or with a torch to approximately 275°F. It is best to heat in oil if possible; however, if a torch is used, be sure the drum and hub are heated uniformly.

5. Have hydraulic press or driving bars available for driving the heated drum and hub home on the shaft. The heat transferred from the combination drum and hub to the shaft will be rather rapid which will cause the shaft to expand and possibly create interference during assembly. Because of this, it is very important to drive the drum and hub home as rapidly as possible. If the drum and hub has been heated sufficiently, it should slide on the shaft relatively easy. If separate clutch and brake drums (7A) are used, repeat steps two through five for the brake drum.

6. Allow time for the drum and hub to cool to room temperature.

7. When the drum and hub has cooled sufficiently, install the inboard Timken Bearing Cone (3). Preheat this bearing cone in hot oil to facilitate easier assembly.

NOTE: Once assembled, the bearing should be "held" against the shoulder of the drum, while cooling.

IMPORTANT: After bearing has cooled thoroughly, hand pack it with grease before installing flywheel or bullgear assembly. Use Mobilux # 2 or equivalent non-fibrous grease.

8. Install the factory-assembled unit consisting of the flywheel or bullgear (1), clutch (4), oil seal (2) and outer Timken bearing race. When sliding the assembly into position, CARE MUST BE TAKEN so as not to damage the oil seal (2).

9. With flywheel in position, pack flywheel cavity with grease (approximately half full) before installation of outer Timken bearing cone (3A). Next, hand pack bearing cone with grease and carefully place in position. This is a loose fit and does not require preheating.

10. Securethe end plate (17) or (36) with cap screws (18) to the drum hub without shimming. Gently tighten the cap screws uniformly while slowly rotating the flywheel until- flywheel bearings start to drag.

11. Insert a depth gauge in the 5/16 hole provided in the end plate and measure the distance to the drum hub (A). Subtract the end plate thickness from thisdepth gauge reading and then add .005" to .007" which determines the shim pack thickness required to provide adequate running clearance. See Fig. A.

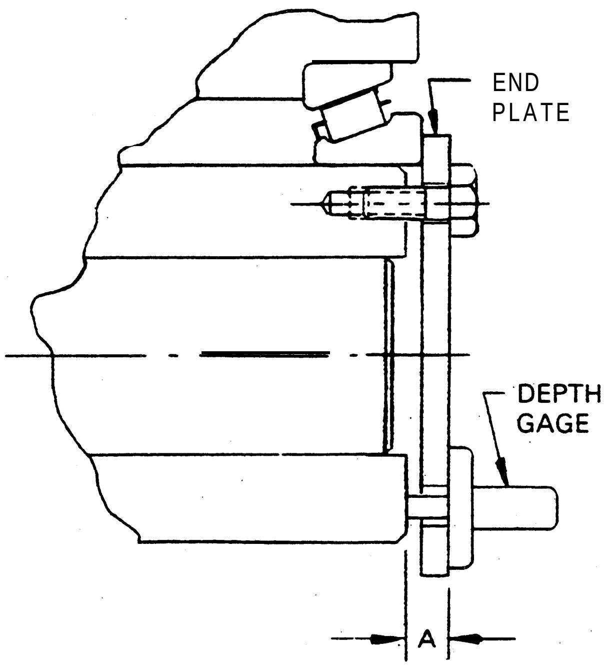


FIG. A

12. Remove the end plate and. add the appropriate shims (19) to provide recommended running clearance.

CAUTION: Secure flywheel before removing end plate and hold outer Timken Bearing in place while end plate is removed. With shims in place, secure the end plate with cap screws.

13. Mount the component parts for air distribution to the clutch as follows:

Timing Rotorseal Mounting

a) Install the timing rotorseal drive screw (37). Tighten the screw and then tie-wire to the four end plate mounting screws. Do not distort end plate while tightening screws.

b) Install the timing rotorseal (10) on flywheel (1) or bullgear hub.. Align the tang of the drive shaft with the slot in the mating drivescrew, AND SIMULTANEOUSLY ALIGN THE GREASE HOLES IN THE ADAPTER FLANGE WITH THOSE IN THE FLYWHEEL. Tighten the mounting bolts uniformly so the adapter flange will fit squarely against the register face.

c) 'Screw tne quick release valves (8) into the flywheel or bullgear web and position them so that the exhaust ports are tangent to the direction of rotation. 'See Fig. B.

When tightening, exercise reasonable care,so as not to distort the quick release valve bodies.

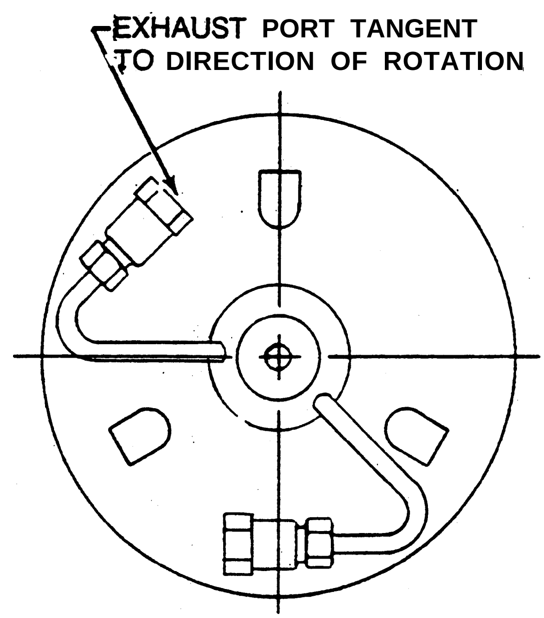


FIG. B

d) Install multiple iniet air tubes (9) into timing rotorseal and quick release 'valves. Check for air leaks.

e) Adjust the timing rotorseal in accordance with form TRS 3064. Use flexible electrical conduit when wiring.

Rotorseal Mounting

a) Tie-wire end plate cap screws.

b) Install the rotorseai adapter (13) on the flywheel hub. BE SURE THE GREASE FITTING HOLES IN THE ADAPTER FLANGE ARE PROPERLY ALIGNED WITH THE MATING FLYWHEEL GREASE HOLES.

c) Screw the quick release valves (8) into the flywheel or bullgear web and position them so that the exhaust ports are tangent to and away from the direction of rotation. See Fig. B. Be careful so as not to distort the aluminum quick-release valve bodies.

d) install multiple inlet air tubes (14) into rotor-seal adapter and quick release valves.

e) if an Airflex cam limit switch is used, adjust in accordance with form TRS 3064.

f) The cam limit switch is available for shaft mounting or foot mounting.

The shaft mounted cam limit switch has a mounting flange with four equally spaced 13/32 diameter mounting holes on a 3-1/4 bolt circle. It is directly attached to the crankshaft end. Drill a 3/8 diameter by l-1/4 deep pilot hole in the crankshaft to pilot the timer. This hole must be square and concentric with crankshaft. Refer to TRS 3064 for specifics.

The foot mounted cam limit switch has a mounting base with four mounting slots. This switch is used where shaft mounting is impossible. A bracket must be fabricated or a surface prepared for mounting the switch. it has a chain and sprocket drive. One sprocket must be attached to the crankshaft and one to the switch shaft. The sprocket ratio must be 1:1. Chain must be furnished by customer. if sprockets are furnished by Airflex, 3/8 pitch chain is required.

14. Mount the spring applied brake (5) on the brake drum as described in form CS 8000. If other designs or Airflex brakes are used, follow appropriate instructions.

15. Install the shaft, clutch and flywheel assembly on the machine and secure the shaft bearings.

16. Select a suitable location for anchoring the brake reaction pin and bracket. See brake instructions.

17. With the clutch, brake and flywheel (or bullgear) mounted, the electrical controls and air piping can be installed and completed.

B. AIR SYSTEM

Refer to the enclosed control and pneumatic piping drawing and follow closely the instructions provided. Full size rigid piping should be used. Use full size air line components such as regulators, filters, etc., and install them ahead of the air receiver tank. The dual solenoid valve is mounted between the air receiver tank and the clutch and brake. Be sure to use the flexible hose furnished between the piping and the brake and between the piping and the rotorseal. Ail piping must be full size to avoid restrictions.

On certain Air-flex clutch-brake applications the user may desire low operating air pressure to the clutch for overload protection. Since the brake is spring applied and air released, reduced air pressure may cause sluggish brake action and result in overlap between clutch and brake. Extremely low air pressure may not actuate the brake. This condition may be alleviated by reducing the brake spring tension; however, this solution is also limited because light spring tension will affect brake torque. A two pressure air system may be necessary to provide this overload protection. To comply with OSHA a second dual valve is required for the brake and should be mounted close to the brake and fed by air at supply line pressure. Reduced air pressure would be supplied to the clutch dual valve through a pressure regulator. The solenoid coils of both dual valves are wired in parallel.

Under extremely humid conditions, or where excessive moisture in the air lines is not completely filtered out, a lubricator may be used if desired. When used, the lubricator should then be the oil mist type.

After the electrical controls have been properly installed and wired and the air piping completed, follow the clutch and brake synchronizing instructions on form CP 3083.

III. MAINTENANCE

The various components of the Airflex FSPA require periodic maintenance to keep them in good working condition. For detailed maintenance instructions see the respective manual as listed below:

Component	Manual Number
CB Element	CB 4000
VC Element	VC 5000
CS Brake	CS 8000
CTF Brake	CTF 8030
DB Brake	DB 8060
Rotorseal	RS 9010
Quick Release Valve	QRV 9090
Timing Rotorseal	TRS 3064
Press Controls	CP 3080
Dual Valve	CP 3082

This folder does not contain all the manuals listed here. Only the manuals pertaining to this particular application have been included.

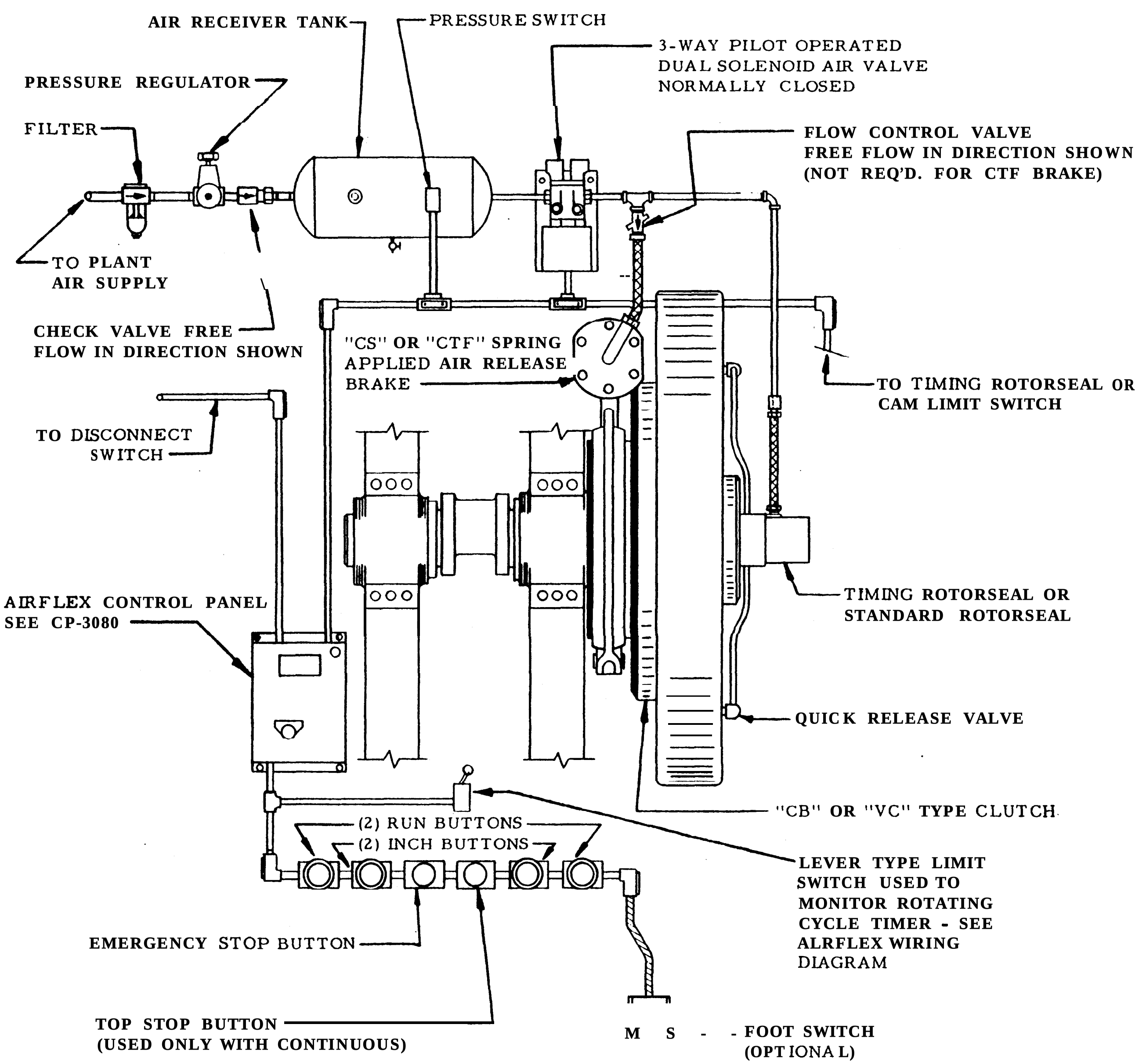
Lubrication - With proper grease packed in bearings at time of installation, they should not require lubrication for several months under normal operating conditions. Lubrication should then be done at regular Intervals established by similar equipment.

Air line lubricators are not required for this equipment. The clutch tube and solenoid valve do not need lubrication, and the "CS" brake cylinder is packed with grease at the factory.

For further information call or write Eaton Corporation, Industrial Drives Operations. Airflex Division, 9919 Clinton Road, Cleveland, Ohio 44144, telephone (216) 281-2211.

CONTROLS AND PNEUMATIC PIPING FOR
"CB" OR "VC" CLUTCH AND "CS" OR "CTF" BRAKE.

FORM CP 3086



1) USE CLEAN PIPE, WHICH IS FREE OF RUST, CHIPS, DIRT, ETC. THE PIPING & AIR SYSTEM COMPONENTS MUST BE FULL SIZE, WITH A MINIMUM NUMBER OF ELBOWS AND OTHER RESTRICTIONS.

2) USE PIPE DOPE SPARINGLY, EXCESSIVE AMOUNTS MAY CLOG PNEUMATIC COMPONENTS AND RESTRICT AIR FLOW.

3) INSTALL AN AIR FILTER AHEAD OF PRESSURE REGULATOR TO PREVENT CONTAMINATION OF AIR SYSTEM COMPONENTS.

4) NORMAL OPERATING AIR PRESSURE IS 75 P.S. I. MAXIMUM AIR PRESSURE IS 110 P.S. I. IF REQUIREMENTS EXCEED 110 P. S. I. CONSULT WITH FACTORY,

5) MOUNT DUAL SOLENOID VALVE AS CLOSE AS POSSIBLE TO RESPECTIVE CLUTCH AND BRAKE. SPLIT APPLICATIONS REQUIRE THAT THE VALVE BE MOUNTED CLOSER TO THE CLUTCH.

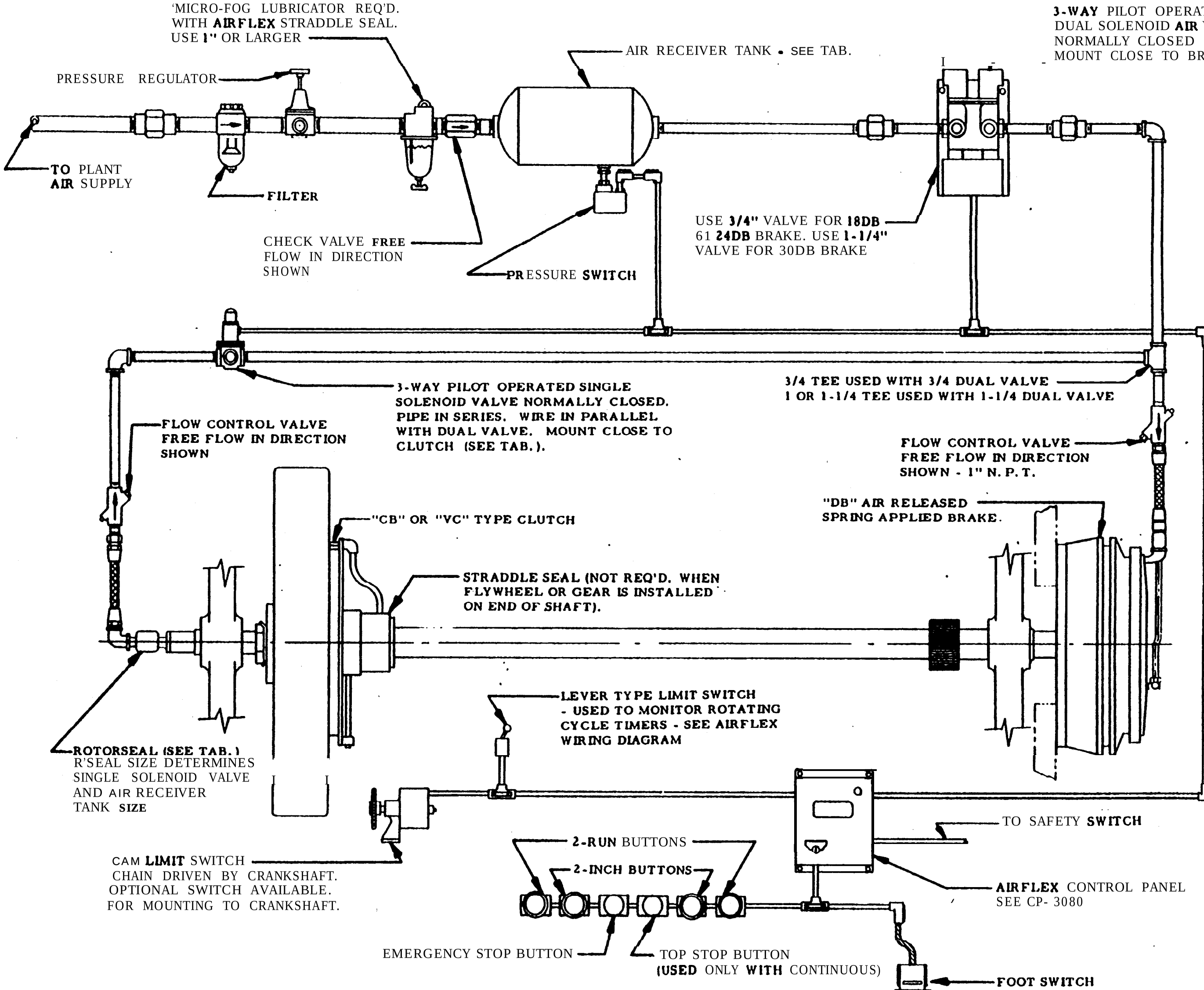
6) QUICK RELEASE VALVES AT THE CLUTCH SHOULD BE CHECKED FOR EXHAUSTING FOLLOWING PIPING INSTALLATION. FOREIGN MATERIAL CAN INHIBIT QUICK RELEASE VALVE PLUNGER ACTUATION WHEN AIR IS FIRST APPLIED. SEE QUICK RELEASE VALVE INSTRUCTION FORM QRV 9080.

7) PROPER INSTALLATION AND ADJUSTMENT OF FLOW CONTROL VALVE IS OF EXTREME IMPORTANCE. SEE CP 3084.

THIS DRAWING ALSO APPLICABLE FOR BRAKE MOUNTED AT OPPOSITE END OF SHAFT,

SYSTEM DESIGNED TO COMPLY WITH . AIRFLEX INTERPRETATION OF 0. S. H. A. REQUIREMENTS PERTAINING TO EQUIPMENT SHOWN

CONTROL AND PNEUMATIC PIPING FOR "CB" OR "VC" CLUTCH AND "DB" BRAKE



1. USE CLEAN PIPE, WHICH IS FREE OF RUST, CHIPS, DIRT, ETC. THE PIPING AIR SYSTEM COMPONENTS MUST BE FULL SIZE WITH A MINIMUM NUMBER OF ELBOWS AND OTHER RESTRICTIONS.
2. USE PIPE DOPE SPARINGLY: EXCESSIVE AMOUNTS MAY CLOG PNEUMATIC COMPONENTS AND RESTRICT AIR FLOW.
3. MSTALL AN AIR FILTER AHEAD OF PRESSURE REGULATOR TO PREVENT CONTAMINATION OF AIR SYSTEM COMPONENTS.
4. NORMAL OPERATING AIR PRESSURE IS 75 P.S. 1. MAXIMUM AIR PRESSURE IS 110 P.S. t. IF REQUIREMENTS EXCEED t 10 P.S. I. CONSULT WITH FACTORY.
5. QUICK RELEASE VALVES AT THE CLUTCH SHOULD BE CHECKED FOR EXHAUSTING FOLLOWING PIPING INSTALLATION. FOREIGN MATERIAL CAN INHIBIT QUICK RELEASE VALVE PLUNGER ACTUATION WHEN AIR IS FIRST APPLIED. SEE QUICK RELEASE VALVE INSTRUCTION FORM QRV 9080.
6. PROPER INSTALLATION AND ADJUSTMENT OF FLOW CONTROL VALVES IS OF EXTREME IMPORTANCE. SEE INSTRUCTION FORM CP-3084.

THIS DRAWING ALSO APPLICABLE WHERE CLUTCH AND BRAKE ARE MOUNTED IN OTHER LOCATIONS ALONG THE SHAFT,

SYSTEM DESIGNED TO COMPLY WITH AIRFLEX INTERPRETATION OF O.S. H. A. REQUIREMENTS PERTAINING TO EQUIPMENT SHOWN

ROTORSEAL		SINGLE SOLENOID VALVE		AIR RECEIVER TANK	
SIZE	AIRFLEX PT. NO.	PORT SIZE	AIRFLEX PT. NO.	SIZE	AIRFLEX PT. NO.
C 2	145107-AA	3/4	63x305	10 24 LG.	156x4
3/4 RH	145487-D	3/4	63x305	16 DIA. 38 LG	156x2
1" RH	145488-D	1"	63x31 I	16 DIA. 38 LG	156x2
1-1/4 RH	145489-H	1"	63x311	16 DIA. 38 LG	156X2

SYNCHRONIZING INSTRUCTIONS
FOR
AIRFLEX CLUTCHES AND BRAKES

REQUIREMENT: Rapid response is only one of the advantages of the Air-flex air applied clutch and spring applied brake combination, and there are some applications which require a degree of control over the actuation of the clutch or brake to prevent the occurrence of OVERLAP. Engagement of the clutch prior to full brake release, or brake engagement prior to full clutch release produces OVERLAP. Harmful effects, such as overheating and accelerated lining wear are the results of this condition. When OVERLAP exists, clutch-brake synchronization, by means of flow control, is required.

DETECTION OF OVERLAP: Whenever OVERLAP is suspected, it is a simple matter to detect its occurrence as well as its magnitude. Using a "Clamp on Ammeter" around one of the motor leads, observe the motor current as the clutch and brake are cycled normally on Single Stroke. NOTE: On high speed *machines, the motor current fluctuation may be to rapid to take an accurate reading, so under these conditions the machine should be operated on "Continuous" to make the check for "OVERLAP". In either case, if the motor inrush current exceeds normal ampere readings at the beginning or end of a cycle, an OVERLAP condition exists. NOTE: See typical motor current curve attached. The amplitude of the curve may deviate somewhat from the illustration, but the important sections of the curve to observe are the shaded, dotted line areas. This represents either clutch overlapping the brake or the brake overlapping the clutch as indicated. While it is possible for both or either of these conditions to exist, the most common is the brake overlap curve. The greater the amplitude of this curve, the more severe the overlap.

CAUSES OF OVERLAP:

1. Low air pressure, air leaks, or insufficient air supply will cause sluggish release of spring applied brakes.
2. Plugged up air line filters or lubricators, and undersized pipe lines can all offer restrictions, which will cause sluggish clutch-brake action.
3. Quick Release Valve malfunction on the clutch can delay clutch release.

SYNCHRONIZING PROCEDURE: If it is determined that overlap does exist and is not caused by any of the conditions listed above, it is necessary to **flow-control** either the air to the clutch or exhaust air from the brake. If the motor current surge is noted at the beginning of the cycle, the clutch engagement must be slightly delayed by using a clutch solenoid valve. If the surge is at the completion of the cycle, the flow control valve will be used to restrict. the brake air exhaust and dampen brake engagement, to permit complete disengagement of the clutch prior to setting the brake.

FLOW CONTROL VALVE: The proper size flow control valve must be used, in accordance with the pipe line size, or larger. During installation observe the "Free Flow" direction of the valve, normally indicated by an "arrow" stamped on the valve body. When used for controlling the clutch, the "Free Flow" direction must be away from the clutch. On a spring applied brake, it must point "Towards" the brake. NOTE: Flow control valve should be installed as close as possible to clutch or brake.

ADJUSTMENT: Normal procedure is to set the Flow Control Valve at some reduced setting and by experimentation, gradually increase the opening until the desired results are obtained. Using the clamp on ammeter, adjust the flow control valve until the overlap is eliminated, or reduced to an absolute minimum. After final adjustment, lock the valve in position.

CAUTION: Excessive flow control will produce sluggish reaction of the clutch or brake and erratic stopping characteristics.

TIMING: With proper Flow Control adjustment, the Top Stop position may require adjustment. This must be accomplished with the Timer.

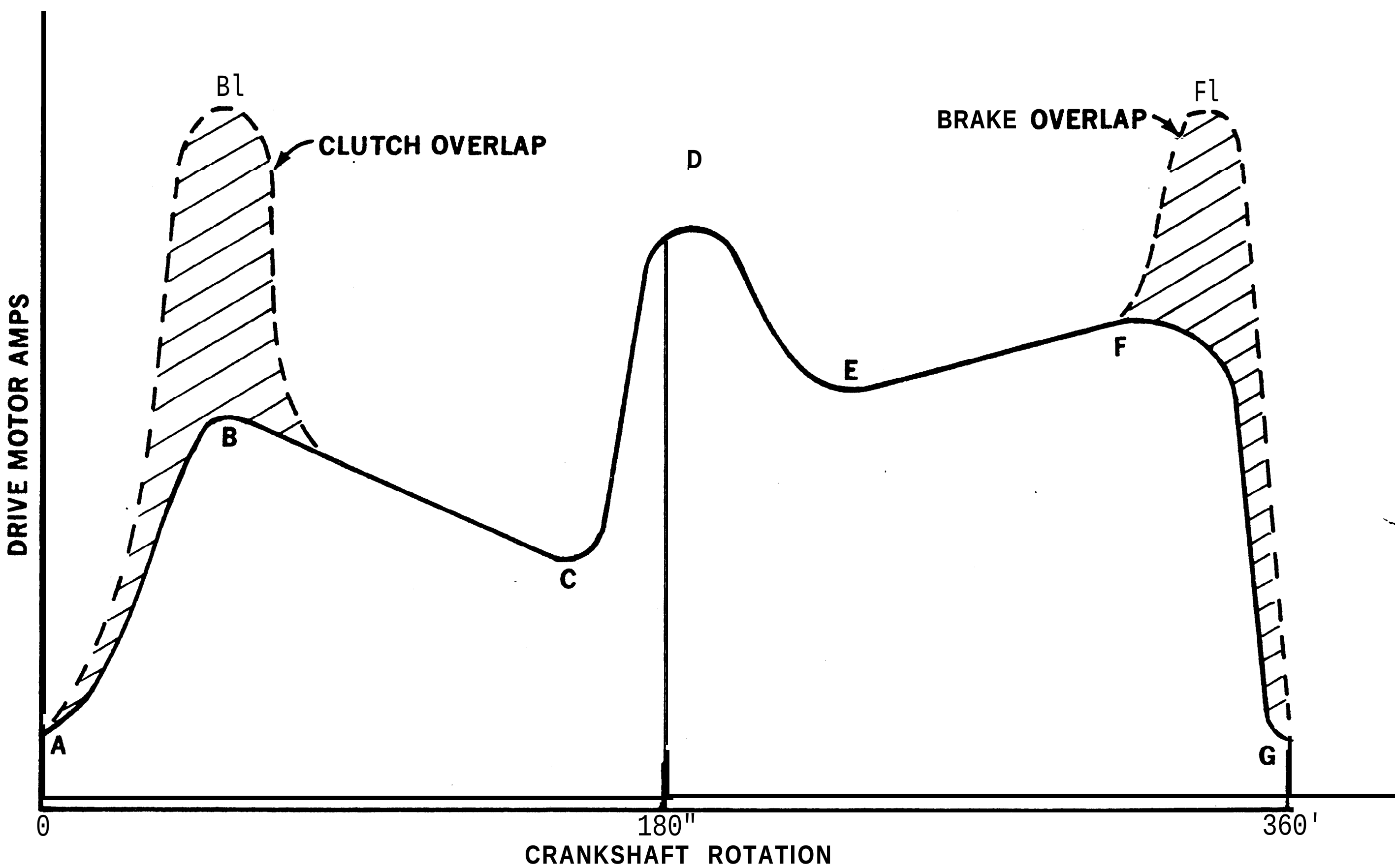
DO NOT attempt the Top Stop adjustment with the Flow Control Valve.

NOTE: For more detailed instructions on Flow Control Valves, refer to Form CP3084.

TYPICAL MOTOR AMPERE CURVE

SOLID LINE- NORMAL CURRENT FLUCTUATIONS DURING COMPLETE CYCLE

DOTTED LINE-ABNORMAL CURRENT SURGES INDICATING OVERLAP



A-B	NORMAL MOTOR AMP SURGE-DURING ACCELERATION
A-B1	ABNORMAL SURGE INDICATES CLUTCH OVERLAP
B-C	RAM ON DOWNSTROKE-MOTOR AMPS DROP
C-D	AMPERE SURGE AS DIES MAKE CONTACT
E-F	RAM MOVING UP BACK STROKE
F-G	CLUTCH RELEASE, BRAKE SET-NORMAL DROP TO NO LOAD AMPS
F-F1-G	AMPERE SURGE INDICATES BRAKE OVERLAP

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Industrial Drives Operations
Airflex Division
9919 Clinton Road
Cleveland, OH 44144
Telephone (216) 2814211

EATON Power Transmission Systems

FLOW CONTROL VALVES
INSTALLATION, OPERATION AND ADJUSTMENT INSTRUCTIONS

WHEN TO USE: The primary function of a Flow Control Valve when used with air clutches and brakes is to provide "delayed action" and eliminate "OVER LAP" between the clutch and brake. (See Note) The Flow Control Valve provides adjustable restricted flow in one direction and unrestricted "FREE FLOW" in the opposite direction. It can also be used to provide "soft" or slow engagement of the clutch or brake to eliminate motor overloads, and shock induced by fast starts.

NOTE: Overlap refers to simultaneous engagement of the clutch and brake either at the beginning or the end of the cycle. Overheating and excessive wear are the results of overlap.

INSTALLATION: A Flow Control Valve should be installed as close as possible to the unit being controlled. Full size piping should be used, according to valve size, to avoid unnecessary restrictions.

IMPORTANT: When used with a clutch, the FREE FLOW direction must be "Away" from the clutch. When used with a spring-applied brake, the FREE FLOW direction must be "Towards" the brake.

HOW TO SET: To establish the desired clutch and brake action, it may be necessary to experiment with various settings on the Flow Control Valve. Normal procedure is to start at some reduced setting and gradually increase the opening until the desired results are obtained. When making these adjustments the motor current should be observed with a "clamp on" ammeter. Excessive surging of the motor current either at the beginning or end of a cycle indicates OVERLAP, which should be eliminated or reduced to an absolute minimum. After final adjustment lock in position.

THE FLOW CONTROL VALVE DOES NOT COMPENSATE FOR CHANGES IN PRESSURE. IT **IS NOT** A PRESSURE **REGULATOR.**

OPERATION: AFTER THE PROPER SETTING IS ESTABLISHED, LOCK THE ADJUSTMENT IN POSITION. THERE SHOULD BE NO REASON TO READJUST THE VALVE.

Airflex furnishes the Westinghouse Flow Control Valve (FLOREG) in four sizes as follows:

Size	Airflex Part No.	Vendor's Part No.
3/8"	42 x 222	P 53020-2
I/2"	42 x 223	P 53010-2
3/4"	42 x 224	P 55010
1" I	42 x215	P 54986

ADJUSTMENT: Loosen lock nut on adjusting screw and turn screw CLOCKWISE TO **INCREASE** the controlled flow and **COUNTERCLOCKWISE TO** REDUCE the flow. After final adjustment, tighten lock nut.

NOTE: CTF Brakes are flow controlled by a valve with a permanent orifice. No adjustment required.

Power Transmission Systems

Eaton Corporation
Industrial Drives Operations
Airflex Division
9919 Clinton Road
Cleveland, OH 44144
Telephone (216) 281-2211

Airflex®

Form ML-318
Revised September 3, 1997

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EATON PRODUCT WARRANTY

Subject to the conditions stated herein, Eaton Corporation warrants to the Purchaser that each new Airflex Product manufactured by Eaton will be free from failures caused by defects in material and workmanship, and will deliver its rated capacity, for a period of twelve (12) months from the date of shipment to Purchaser, provided such Product is properly installed, properly maintained, operated under normal conditions and with competent supervision. Warranty claims shall be made in writing and the part or parts shall, if requested by Airflex Division, be returned prepaid to the Airflex Division for inspection. Upon a determination that a defect exists, Eaton shall thereupon correct any defect, at its option either by repairing any defective part or parts or by making available at Eaton's plant a repaired or replacement part. This warranty does not extend to normal wear parts or components of the Product, such as friction material and friction surfaces.

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